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## (54) Method and apparatus for applying a material to a web.

(57) This invention relates to the treatment of substrates such as paper with material in repetitive patterns. The substrate web (2) passes beneath an applicator (8) in which orifices for discharging the material onto the web are moved along a path crossing that of the moving web preferably at an angle. The orifices may be formed in an endless belt (9) the lower traverse (28) of which constitutes the floor of a container (23) for the material. The treatment patterns made with this invention can be altered by changing apparatus operating parameters.

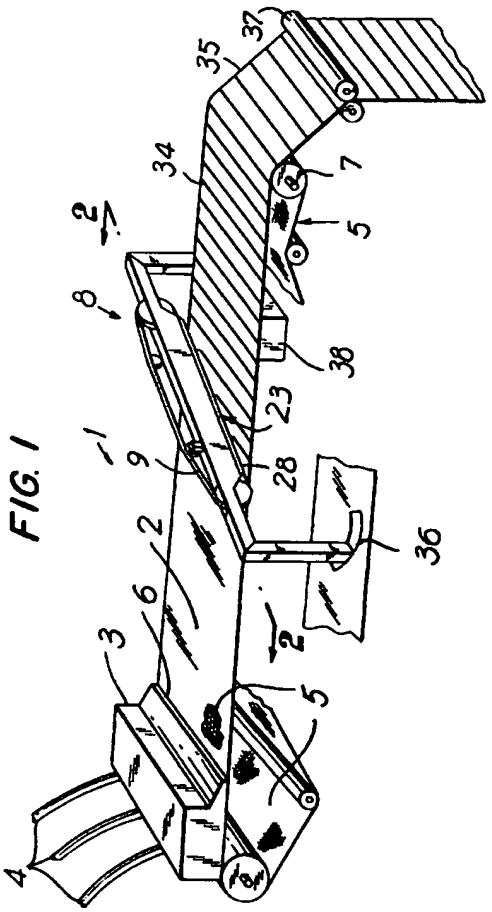


FIG. 1

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## Background of the Invention

This invention relates to a method and apparatus for treating paper with material in repetitive patterns. More particularly, the invention relates to a method and apparatus whereby these repetitive treatment patterns can be applied without contact between the paper and the apparatus.

It is well known in the papermaking art that it is desirable to have the capability to alter or enhance the characteristics of paper. For instance, cigarette manufacturers have long appreciated the usefulness of adding flavorings or burn control additives to paper. Another more recent application that has been identified concerns altering cigarette paper so that smoking articles incorporating the altered paper will have a reduced burn rate when the smoking article is not drawn on by the smoker; but have the same feel, taste and burn when drawn on by the smoker at normal intervals.

Cigarette wrappers, i.e., papers, have burn characteristics, including burn rates and static burn capabilities. It is known that burn characteristics can be modified by adding fillers, coatings, or additives to papers. Copending, commonly-assigned United States patent application Serial No. 07/614,620 includes a description of many of these methods, and also discloses a nonlaminated paper of variable basis weight and suggests that burn rate control of this paper can be achieved economically with mass-production techniques. The variable basis weight is achieved by applying bands of slurry in a pattern to a moving paper web during production while leaving regions of the paper between the pattern untreated. Additional slurry increases the basis weight of the paper in treated regions, and when the paper is incorporated in a smoking article, the smoking article has a decreased burn rate in these regions. Although many methods are known for treating paper with material in patterns, limitations of these methods render them less effective for altering the basis weight of cigarette paper in patterns.

For example, many techniques have been developed for imprinting or coating paper webs. These include gravure presses, blade coating, roller coating, silkscreening and stenciling methods. Bogardy U.S. Patent No. 4,968,534 describes a stenciling apparatus wherein a continuous stencil comes into facing engagement with a paper web during the application procedure. The apparatus includes a preparation step where air is evacuated from the web through the pattern stencil prior to the application step in order to facilitate the treatment procedure. The pattern applied by the device can be altered by changing the stencil used.

The apparatus of Bogardy U.S. Patent No. 4,968,534 is typical of many of the other previously known treatment devices because the apparatus contacts the paper web during the application process. These previously known devices, as a result, can only be used at points in the papermaking process where the paper is sufficiently stable to withstand the contact. This limits flexibility in placement of these devices, because the devices cannot be incorporated in a papermaking machine at relatively early stages of the papermaking process.

Stenciling and other previously known methods generally transfer a predetermined pattern to a treated article. The only way to change the pattern applied is to replace the pattern-forming element of the device. In other words, there is no easy way to alter the pattern by, for instance, merely changing operating parameters. This characteristic particularly limits the applicability of these devices in mass-production situations where it is desirable to apply several patterns to paper being produced.

Another characteristic of previously known devices like that of Bogardy U.S. Patent No. 4,968,534 is that the amount of material applied cannot be varied appreciably. In essence, since the devices are in contact with the web, there must be penetration of the web by the material during the application procedure for significant amounts of material to be applied to the web. The required penetration may not be possible depending on the combined characteristics of the paper and the treatment material, thereby resulting in less than optimum treatment of the paper.

A particular limitation of devices like that of Bogardy U.S. Patent No. 4,968,534 is that a stenciling device incorporating a pattern for applying relatively-closely spaced bands of narrow width to cigarette paper would experience flexure of the stencil and resultant pattern non-uniformity when scaled to the size of a papermaking machine of the type used to make cigarette paper.

A final characteristic of previously known devices is that in order to maintain sufficient pressure, a sump of treatment material is positioned above the stencil. This solution generally requires that sump material be recirculated to a reservoir. This constant recirculation of unused treatment material may allow contamination of the treatment material.

Accordingly, it is an object of the present invention to provide an applicator which can be inexpensively manufactured and easily incorporated into a papermaking machine at various points in the papermaking process.

## Summary of the Invention

In accordance with this invention the method comprises: moving the substrate along a first path; and discharging the material through at least one orifice and onto the substrate; characterized in that the at least one orifice is moved along a second path which includes a portion crossing the first path, and

that the material is communicated with the at least one orifice while the at least one orifice is moving along the said portion of the second path.

Further in accordance with this invention, the applicator comprises means for applying a material to a substrate, comprising means for moving the substrate along a first path, and means including at least one orifice for discharging the material onto the substrate; characterized by means for moving the said at least one orifice along a second path which includes a portion crossing the first path; and means for communicating material with the at least one orifice while the orifice is moving along the said portion of the second path.

It is possible by means of the present invention to provide a moving orifice applicator which selectively applies material in a pattern to a paper web without contacting the moving paper web.

One application of the present invention is to provide a method for treating a paper web where the pattern applied to the web can be changed by altering machine operating parameters.

Another application of the present invention is to provide a method for treating a paper web where the pattern applied to the paper web can be changed by replacing a pattern-forming element.

Another application of this invention is to provide a moving orifice applicator in which the amount of material applied to the paper web can be varied appreciably.

Another application of the present invention is to provide an application method in which a large quantity of web is treated with material in uniform patterns, in a continuous manner, and at high speeds.

Another application of the present invention is to provide an application method where the amount of material being applied can be accurately metered.

Briefly described, the invention comprises an apparatus and method for applying material to paper in a repetitive pattern for the purpose of altering the characteristics of the paper. Although the preferred embodiment describes use of the invention for producing paper with variable burn characteristics, it is expected that the invention could apply many different materials to achieve differing paper characteristics. For instance, the invention can apply compounds which are detectable by electromagnetic means, thus allowing the paper made to be used in security situations. The invention could also be used to apply dyes, inks, or flavorings. It is also contemplated that the invention could treat substrates other than paper.

In the preferred embodiment, the apparatus of this invention, a moving orifice applicator, is mounted on a paper making machine directly over the Fourdrinier wire between the wet line and the couch roll. The applicator consists of continuous steel belt mounted on motor-driven pulleys. The lower traverse of the belt's travel forms the bottom of an enclosed cavity. Orifices on the centerline of the belt are in communication with the cavity. The plane of the lower traverse of the belt is parallel to the plane of the web, and the direction of belt travel is at an angle to the direction of web travel. During operation, slurry is continuously pumped into the enclosed cavity and motion of the belt across the web causes parallel bands of slurry to be applied to the web as slurry passes from the cavity through the orifices and onto the web. The relative angle of bands applied to the web with respect to the wen and their spacing can be easily changed by altering the relative angle and speed of the belt and web without having to change the belt as in previously known devices. The width of bands can be changed by altering the application pressure of the , slurry without having to change the pattern belt as in previously known devices.

In an alternate embodiment of the invention the moving orifice applicator can be incorporated in a machine to treat finished; dry paper. This embodiment includes a drying means to facilitate the drying of bands applied to the web.

In other alternate embodiments of the invention, the pattern-forming element of the apparatus contains patterns of orifices of either varying sizes or spacings with the result that the pattern applied consists of a repetitive sequence of bands of varying sizes or spacings.

## Brief Description Of The Drawings

The above and other objects and advantages of this invention will be apparent upon consideration of the following detailed description, taken in conjunction with the accompanying drawings, in which like reference characters refer to like parts throughout, and in which:

FIG. 1 is a perspective view of a papermaking machine incorporating the present invention;

FIG. 2 is a vertical cross-sectional view of a moving orifice assembly in accordance with the invention, taken along line 2-2 of FIG. 1;

FIG. 3 is a partially fragmentary perspective view of the cavity block assembly of the moving orifice assembly of FIG. 2;

FIG. 4 is a perspective view of an alternative embodiment of the invention;

FIG. 5 is a schematic view of an alternative embodiment of the invention; and

FIG. 6 is a schematic view of an alternative embodiment of the invention.

## Detailed Description of the Invention

The present invention relates to a method and apparatus for altering the characteristics of paper by treating the paper during or after the production process. With this invention many different paper charac-

teristics can be achieved. For example, materials that confer distinctive characteristics upon the paper, such as compounds which are detectable by electromagnetic means, could be applied with the invention. Inks, dyes or flavorings could also be applied with the invention. The invention could also be used to apply a pattern of flavor generating material, or a pattern of electrically conductive, resistive or insulating material, for use in a flavor generating article such as that disclosed in commonly assigned U.S. Patent No. 5,060,671. In addition, the invention could treat substrates other than paper. Although the first preferred embodiment of the invention relates to treatment of cigarette paper, those skilled in the papermaking art will realize that the invention has many applications.

The first preferred embodiment of the invention concerns a method and apparatus for altering the basis weight of cigarette paper in select regions so that the burn rate characteristics are altered in these regions. As used herein, "base web" relates to untreated regions of paper and "cross-directional regions" are the regions of increased basis weight in the cross-direction of web travel. These "cross-directional regions" are achieved by applying "bands" of slurry in an "application pattern."

An increase in basis weight may be achieved by providing a paper with localized regions of either (1) increased thickness or (2) increased density, or both. The increase in basis weight may be accomplished by depositing, onto an existing pulp web in a papermaking machine, additional material such as a second quantity of cellulosic pulp, or, alternatively, a filler material. Some examples of additional materials are highly refined cellulosic pulp, high surface area cellulosic fibers such as cellulon, microcrystalline cellulose such as Avicel or a mixture of highly refined pulp and calcium carbonate. Other insoluble, cellulose-compatible materials could also be used, such as amylopectin or certain modified celluloses.

The cross-directional regions made with this invention preferably have a basis weight above that of the base web. When paper made with the present invention is incorporated in a smoking article, the smoking article has variable burn rate characteristics. For example, the static burn rate of the smoking article is substantially decreased in the cross-directional regions. The regions of increased basis weight have decreased porosity. The rate of oxygen diffusion through the paper in these regions is thereby decreased, retarding combustion of the smoking article.

The dimensions of the cross-directional regions will also affect the burn characteristics of the paper and, consequently, the smoking article. In particular, the width of the cross-directional regions exerts a substantial effect on the burn rate, and the greater the separation between cross-directional regions, the faster a smoking article made from the paper will burn.

The present invention provides a method and apparatus for applying slurry in an application pattern to form the cross-directional regions. The method and apparatus of this invention allow the application pattern to be changed by adjustment of machine operating parameters, thereby altering the spacing and width of the cross-directional regions comprising the application pattern. This allows the same machine to make papers with differing variable burn rate characteristics. The pattern-forming element of the invention can also be replaced. This allows the apparatus of this invention to apply patterns consisting of bands of varying widths or spacings.

The first preferred embodiment of the apparatus of this invention is shown in FIG. 1 which depicts the pulp web-forming area of a conventional Fourdrinier papermaking machine 1, adapted to produce a continuous pulp web 2. A headbox 3 contains a quantity of cellulosic pulp which is supplied to headbox 3 by a plurality of conduits 4 which communicate with a pulp source (not shown). A common pulp source is a pulp storage tank, which is not shown.

Immediately below headbox 3 is an endless forming wire 5. A slice 6 defined in a lower portion of headbox 3 adjacent to wire 5 permits the pulp from the headbox to flow through slice 6 onto the top surface of the wire 5 to form pulp web 2. Slice 6 is usually of narrow vertical width in order to regulate the amount of pulp which flows from headbox 3. The length of slice 6 extends substantially the entire width of pulp web 2.

The top portion of wire 5 is adapted to move forwardly toward a couch roll 7 and away from slice 6. The direction from headbox 3 toward couch roll 7 is the downstream direction. Once the pulp web has been formed, it passes under the apparatus of this invention, a moving orifice applicator 8, which deposits additional material onto the pulp web 2. This material forms the cross-directional regions which comprise the application pattern. From FIG. 1 it is apparent that the moving orifice applicator 8 does not contact the pulp web 2 during the application procedure.

As shown to better advantage in FIG. 2, the moving orifice applicator 8 consists in part of a continuous moving belt 9, which preferably is made of steel. The continuous moving belt 9 is mounted on a main drive wheel 10 and main idler wheel 11. The main drive wheel may be driven for rotation by any suitable means (not shown).

The moving orifice applicator 8 has a main frame 12 composed of an I-beam. The main frame 12 could be constructed of cast aluminum. Welded at both ends of frame are brackets 13. These brackets support the main idler wheel 11 and main drive wheel 10.

The main frame 12 has a top flange 14. The top flange 14 supports the fixed idler wheel yoke 15. The fixed idler wheel 16 is mounted in the fixed idler wheel yoke 15. Also mounted on the top flange 14 is the ten-

sion pivot yoke 17. The tension yoke 18 is pivotally mounted on the tension pivot yoke 17. The tension wheel 19 is mounted on the tension yoke 18. The axes of the tension wheel 19 and fixed idler wheel 16 can be adjusted by handles 20. This adjustment is necessary so that the continuous moving belt 9 can be steered. Welded steel belts have a tendency to pull to one side or the other. Adjustment of the fixed idler wheel 16 and tension wheel 19 axes by means of the handles 20 ensures that the continuous moving belt 9 tracks properly. The tension yoke 18 also pivots on tension pivot yoke 17. This is adjustable by handle 21. Adjustment of handle 21 alters the tension of the continuous moving belt 9, thereby reducing belt slippage. Handle 21 also relieves tension to facilitate replacement of the continuous moving belt 9.

Mounted to the bottom flange 22 of frame 12 is the cavity block assembly 23. The cavity block assembly 23 retains the slurry to be applied to the pulp web during the application procedure. Slurry is supplied under pressure to the cavity block assembly 23 from a slurry supply source (not shown) through a plurality of inlets 24.

The particulars of the cavity block assembly 23 are shown to better advantage in FIG. 3. The cavity block assembly 23 has a cavity block 25 which encloses an interior cavity 26 on five sides. The cavity block 25 does not enclose the bottom of the cavity 26. Instead a shield 27 and a portion of the lower traverse 28 of the continuous moving belt 9 enclose the bottom of the cavity 26. The continuous moving belt 9 has a plurality of orifices 29 disposed along its center line 30. These orifices 29 are in communication with the cavity 26 during a portion of the lower traverse 28 of the continuous moving belt 9. The continuous moving belt 9 passes through a slot 31 formed by the shield 27 and the cavity floor 32. In order to ensure that the orifices 29 in the continuous moving belt 9 remain in communication with the cavity 26, the shield has a slot 33 machined along its center line. This slot 33 allows the orifices 29 in the continuous moving belt 9 to remain in communication with the cavity 26, while minimizing the amount of slurry in the cavity 26 which contacts the continuous moving belt 9. This is necessary because an unshielded continuous moving belt would have a greater pumping effect on the slurry. This pumping effect is exhibited by a displacement of slurry in the cavity in the direction of travel of the continuous moving belt. If this effect were not minimized through the use of a shield, the application pattern might be less uniform.

As the orifices 29 in the continuous moving belt 9 come into communication with the cavity 26 in the cavity block assembly 23 during the lower traverse 28 of the continuous moving belt 9, slurry which has been supplied to the cavity block assembly 23 is forced out through the orifices 29 and onto the pulp web 2. The motion of each orifice 29 across the pulp web 2 causes a series of bands 34 to be applied to the pulp web 2. These bands 34 constitute the cross-directional regions of the application pattern.

Referring again to FIG. 1, the application pattern 35 formed on the moving paper web consists of a series of equally spaced bands 34, each band 34 being of equal width, and each band perpendicular to web travel. The moving orifice applicator 8 is mounted so that the direction of the lower traverse 28 of the continuous moving belt 9 is at an angle to the direction of travel of the pulp web 2. Accordingly, for the moving orifice applicator 8 to create bands 34 perpendicular to web travel, the lower traverse 28 of the continuous moving belt 9 must have a velocity component in the direction of travel of the pulp web 2 which is equal to the velocity of the pulp web 2.

The orientation of the bands applied to the moving pulp web with respect to the moving pulp web can be altered. For instance, if it is desired that the bands be at an angle to web travel, instead of perpendicular, this can be easily accomplished by changing the relationship of the velocity component of the continuous moving belt 9 in the direction of the pulp web 2 and the velocity of the pulp web 2. As long as they are equal, the bands 34 applied will be perpendicular to web travel. If a differential is introduced, then the bands 34 applied will be at an angle to web travel.

One feature of the invention is that the spacing of the bands can be changed without having to replace the pattern-forming element of the apparatus. In the present invention this is accomplished by changing the angle of the lower traverse 28 of the continuous moving belt 9 while maintaining the component of velocity of the continuous moving belt 9 in the direction of web travel equal to the velocity of web travel. This will ensure that the bands 34 applied remain perpendicular to web travel. This angle change is accomplished by altering the pivot 36.

Another feature of the invention is that the width of bands applied to the moving pulp web 2 can be increased by increasing the application pressure of the material. This is accomplished by increasing the pressure of slurry supplied to the cavity block assembly 23.

An additional feature of the invention is that the amount of material applied to each individual band can easily be increased by decreasing the component of velocity of the continuous moving belt 9 perpendicular to the direction of travel of the moving pulp web 2. In order to maintain a perpendicular application pattern, the velocity of the moving pulp web 2 will have to be decreased.

After the moving orifice applicator 8 has applied the application pattern 35 to the moving pulp web 2, the web continues to move in a downstream direction. As wire 5 begins to move downwardly about couch roll 7 and back toward headbox 3, pulp web 2 is delivered from wire 5 to a plurality of press rolls 37 and then to

a dryer section of papermaking machine. (not shown). As pulp web 2 advances in the downstream direction, excess water is permitted to pass through wire 5. A vacuum 38 typically may be applied to at least a portion of the underside of wire 5 to assist in the removal of water from pulp web 2. Couch roll 7 may be adapted to provide a vacuum through wire 5 to the underside of pulp web 2 to remove additional water.

In an alternate embodiment of the invention shown in FIG. 4, the moving orifice applicator 8 has been incorporated in a machine 39 to treat paper that has already been made. The machine has a roll of premanufactured paper 40 mounted on a feed shaft 41. The paper on the roll 40 is fed between an upper idler 42 and a lower idler 43 and onto a continuous moving web 44. A continuous moving web may not be needed, depending on paper strength. For example, the paper may be supported by a shoe (not shown) familiar to those skilled in the art. The moving orifice applicator 8 is mounted above the continuous moving web 44 which is supporting the paper 45 to be treated. After the application pattern 35 has been applied to the paper 45 by the moving orifice applicator 8, the paper moves underneath a drying means 46. A number of drying means familiar to those skilled in the art including felt absorption, heated drums and infrared drying may be used. After the application pattern 35 has been dried by the drying means 46, the paper moves between the final upper idler 47 and final lower idler 48. The paper 45 is then taken up by a take-up roll 49 mounted on the take-up shaft 50.

In other alternate embodiments of the invention it may be desirable to apply bands of material of varying widths or spacings. This may be true whether the paper web being treated has just been made or is premanufactured. FIGURES 5 and 6 and show how this may be accomplished.

In FIG. 5 the lower traverse 28a of the continuous moving belt 9a is shown in schematic form from above. The continuous moving belt 9 of the first preferred embodiment with its orifices of equal size and spacing has been replaced with a continuous moving belt 9a having orifices 29a of equal size but varying spacing, the spacing repeating in sequence. In this particular embodiment, the component of velocity of the lower traverse 28a of the continuous moving belt in the direction of travel of the moving pulp web 2 is the same as the velocity of the moving pulp web 2 so that bands 34a comprising the application pattern 35a are perpendicular to the direction of travel of the moving pulp web 2.

As shown by FIG. 5 the varying spacing of the orifices 29a of the continuous belt 9a is repeated in the application pattern 35a which consists of a series of bands 34a of varying spacing, the spacing repeating in sequence. Since the continuous moving belt 9a is mounted at an angle to web travel, the actual separation of the bands applied is less than the spacing of the orifices 29a.

FIG. 6 shows how the size of bands applied can be varied. Again the lower traverse 28b of the continuous moving belt 9b is shown from above in schematic form, the lower traverse 28b located directly above the moving pulp web 2. The continuous moving belt of the first preferred embodiment with its orifices of equal size and spacing has been replaced with a continuous moving belt 9b having orifices 29b of equal spacing but varying sizes. Again the component of velocity of the lower traverse 28b of the continuous moving belt 9b is the same as the velocity of the moving pulp web 2 so that bands 34b comprising the application pattern 35b are perpendicular to the direction of travel of the moving pulp web 2. As shown by FIG. 6 the sequence of orifices of varying sizes in the continuous moving belt 9b is repeated in the application pattern 35b which consists of a series of bands 34b of varying sizes, the sizes repeating in sequence.

One skilled in the art will appreciate that the present invention can be practiced by other than the described embodiments, which are presented for purposes of illustration and not of limitation, and the present invention is limited only by the claims that follow.

## Claims

1. A method of applying a material to a substrate, which comprises: moving the substrate along a first path; and discharging the material through at least one orifice and onto the substrate;
   characterized in that the at least one orifice is moved along a second path which includes a portion crossing the first path, and that the material is communicated with the at least one orifice while the at least one orifice is moving along the said portion of the second path.

2. The method of claim 1, wherein the said material comprises a fluid material and the substrate comprises a web.

3. The method of claim 2, wherein said web comprises a paper web.

4. The method of claim 1, wherein a plurality of orifices is moved in sequence along the second path, the said portion of which crosses the first path at an angle and is located directly above the first path; and wherein the material is discharged under pressure through the orifices onto the web located directly below the orifices as they travel along the said portion of the second path, the orifices forming an application pattern on the web comprising a series of substantially parallel bands of the material.

5. The method of claim 4, wherein a continuous moving belt is located above the web and extends across the width of the web, the belt being out of contact with the web and having a plurality of orifices disposed in a pattern of size and spacing along the extent of the belt, the belt having a lower traverse in which the orifices move across the web, the plane of the-lower traverse being parallel to the plane of the web, and the lower traverse crossing the web at an angle to the direction of travel of the web; wherein the material is supplied under presure to the upper surface of a portion of the continuous moving belt forming the said lower traverse; and wherein the material supplied to the said portion of the belt is discharged through the orifices located in the lower traverse and onto the web located directly below the lower traverse to form an application pattern on the web comprising a series of substantially parallel bands of the material.

6. The method of claim 4 or 5, wherein the orifices are of substantially equal size, and the bands forming the application pattern are of substantially equal size.

7. The method of claim 4, 5 or 6 wherein the orifices are of substantially equal spacing and the bands forming the application pattern are of substantially equal spacing.

8. The method of claim 4 or 5, wherein the orifices are arranged in a repetitive pattern of varying sizes and/or spacings and the bands forming the application pattern are arranged in a repetitive pattern of varying sizes and/or spacings.

9. The method of any of claims 4 to 8, wherein a component of the velocity of the moving orifices in the direction of travel of the web is equal to the velocity of the web, and the bands forming the application pattern are perpendicular to the direction of travel of the web.

10. The method of any of claim 4 to 8, wherein a component of the velocity of the moving orifices in the direction of travel of the web is different from the velocity of the web, and the bands forming the application pattern are at an oblique angle to the direction of travel of the web.

11. The method of any of claim 4 to 10, wherein the widths of the bands forming the application pattern are altered by changing the pressure of the material.

12. The method of any of claims 4 to 10, wherein the amount of the material applied to the bands is varied by altering a component of the velocity of the moving orifices perpendicular to the direction of travel of the web.

13. The method of claim 5, wherein the spacing of the bands is altered by changing the angle of the lower traverse of the continuous moving belt relative to the direction of travel of the web.

14. The method of claim 5, wherein the amount of material applied to the bands is varied by altering a component of the velocity of the continuous moving belt perpendicular to the direction of travel of the web.

15. The method of any of claims 4 to 14, comprising the further step of applying a vacuum to the web after the said material has been applied to the web.

16. The method of any of claims 4 to 15, comprising the further step of drying the web after the material has been applied thereto.

17. The method of any of claims 4 to 16, wherein the said web comprises a paper web and the said material comprises a slurry applied in the said application pattern to alter The burn rate characteristics of the paper web.

18. An applicator for applying a material to a substrate, comprising means (5) for moving the substrate (2) along a first path, and means (8) including at least one orifice (29) for discharging the material onto the substrate;

characterized by means (9-11) for moving the said at least one orifice along a second path which includes a portion crossing the first path; and means (23) for communicating material with the at least one orifice while the orifice is moving along the said portion of the second path.

19. The applicator of claim 18 for applying a material to a moving web, comprising: a continuous moving belt (9) having a plurality of orifices (29), a lower traverse (28) of the belt being located above the path of the moving web and at an angle to the direction of travel of the web; drive means (10) for driving the belt; holding means (23) for holding the material above the lower traverse of the belt, the bottom of the holding means being constituted by the inner surface of the belt; and supply means (24) for supplying the said material under pressure to the holding means.

20. The applicator of claim 18 for applying a material to a moving web, the applicator comprising:

a frame (12) with two brackets (13) dis-

posed at
respective ends thereof, one of the brackets holding a drive wheel (10) and a second of the brackets holding an idler wheel (11);

means for driving the drive wheel to drive the continuous moving belt at a predetermined velocity;

a continuous moving belt (9) mounted on the drive and idler wheels (10,11) and having a plurality of orifices (29), the belt having a lower traverse (28) passing directly above the moving web in a plane parallel to the plane of the web, the direction of motion of the lower traverse being at an angle to the direction of motion of the web.

a cavity block (25) located above the moving web and inside the lower traverse of the moving belt, the cavity block enclosing a cavity (26) on five sides with the bottom of said cavity being closed by a portion of the lower traverse of the belt, the cavity block having a plurality of inlets (24) for admitting the said material to the cavity, the said orifices in the moving belt being in communication with the cavity so that material in the cavity can be discharged through the orifices and onto the moving web;

guide means (27,32) for guiding the portion of the lower traverse of the belt which forms the bottom of the cavity block;

and means for supplying the material to the plurality of inlets under pressure.

**21.** The applicator of claim 20, wherein the said guide means comprises a shield (27) and a cavity floor (32) mounted below the said cavity block (25), the shield being positioned above the portion of the moving belt which forms the bottom of the cavity (26) and substantially covering the belt except for a slot (33) in the shield which is aligned with the orifices (29) in the belt so that the orifices remain in communication with the cavity, the cavity floor being positioned below the said portion of belt and substantially covering the belt except for a slot in the cavity floor which is aligned with the orifices in the belt.

**22.** The applicator of claim 19 or 20, wherein the said angle of the lower traverse (28) of the moving belt is variable.

**23.** The applicator of claim 19 or 20, wherein the pressure of material supplied by the supply means is variable.

**24.** The applicator of claim 19 or 20, wherein the velocity of the continuous moving belt (9) is variable over a range of velocities.

**25.** The applicator of claim 19 or 20, wherein the said orifices (29) are of substantially equal size or substantially equally spaced along the continuous moving belt (9).

**26.** The applicator of claim 19 or 20, wherein the said orifices (29) are arranged in a repetitive pattern of varying sizes or varying spacings.

**27.** The applicator of claim 19 or 20, wherein the said orifices (29) are disposed along a centerline of the moving belt (9).

**28.** The applicator of claim 19 or 20, including tensioning means (17-21) for adjusting the tension of the moving belt (9).

**29.** The applicator of claim 19 or 20, including steering means for steering the continuous moving belt (9).

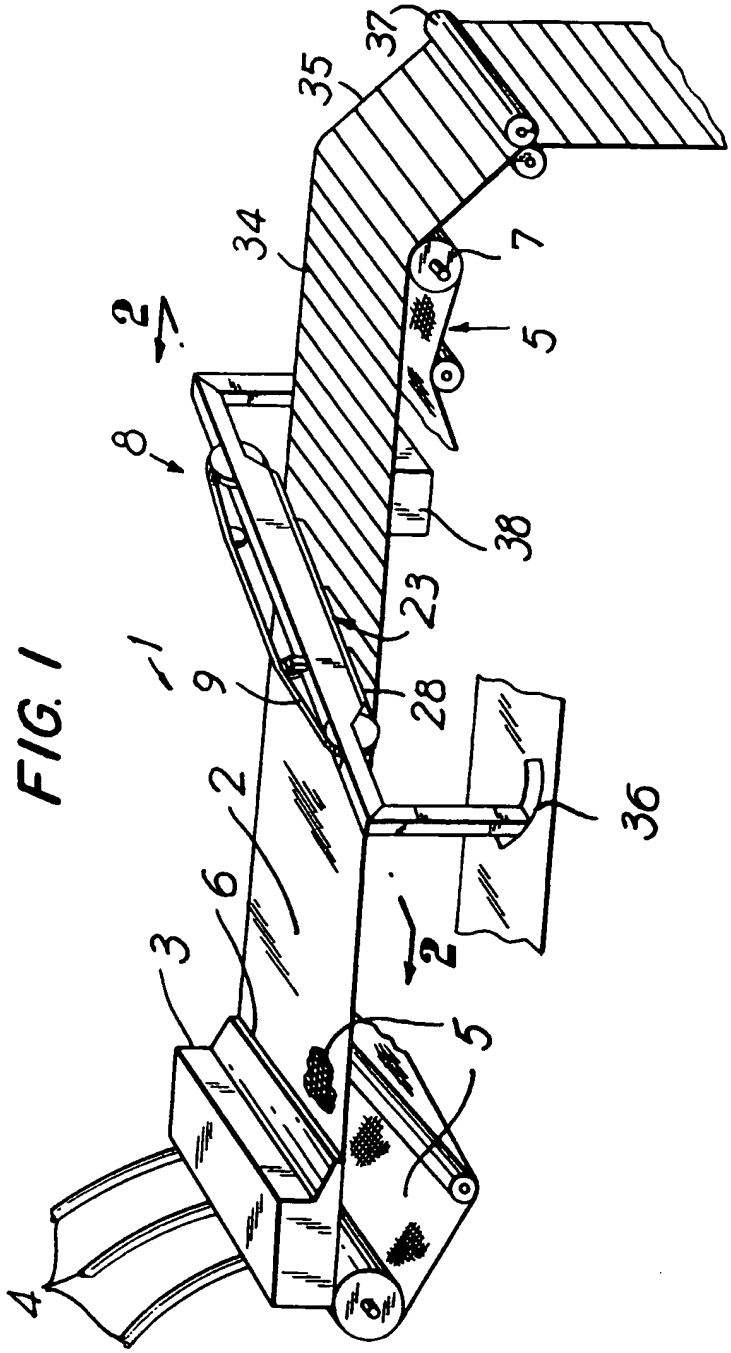
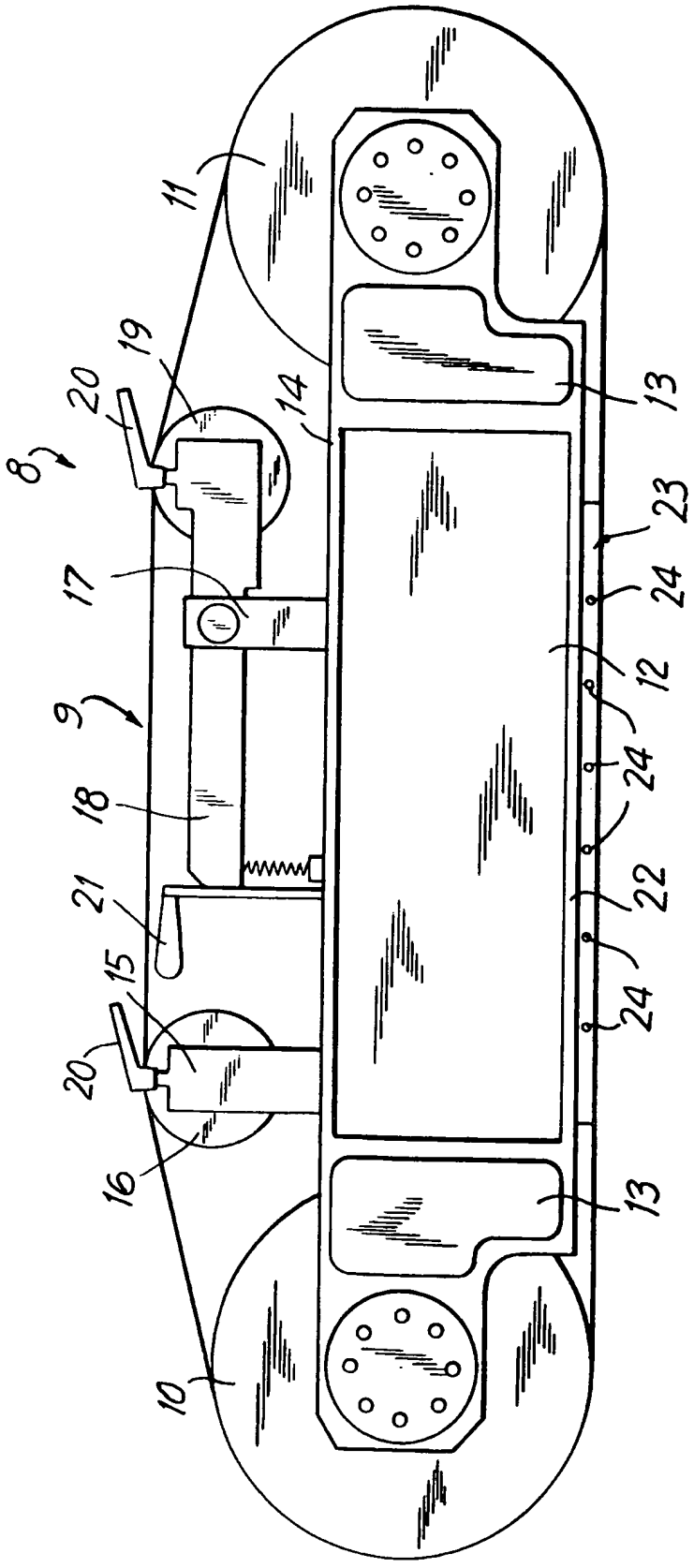



FIG. 1

FIG. 2



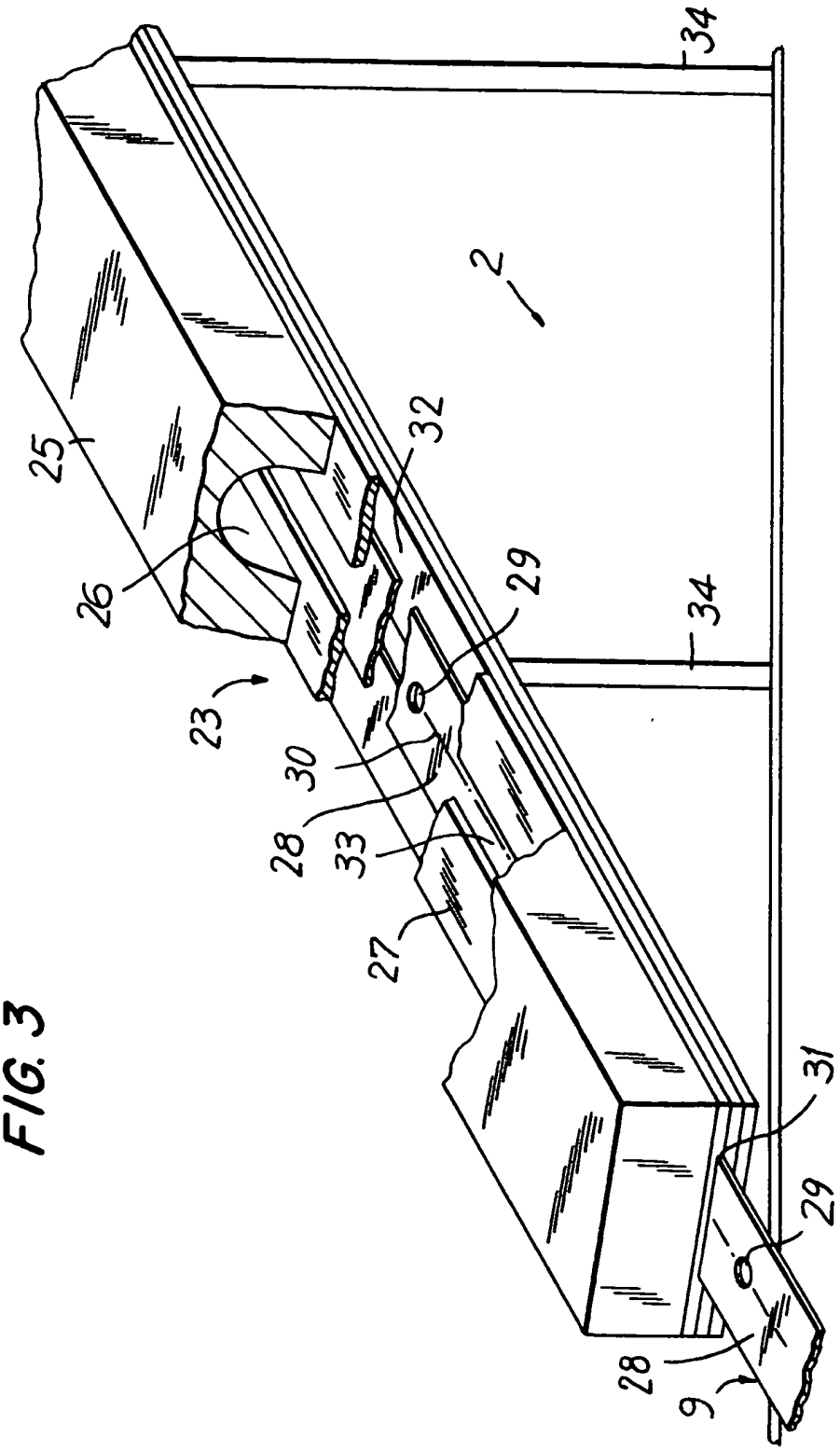



FIG. 3

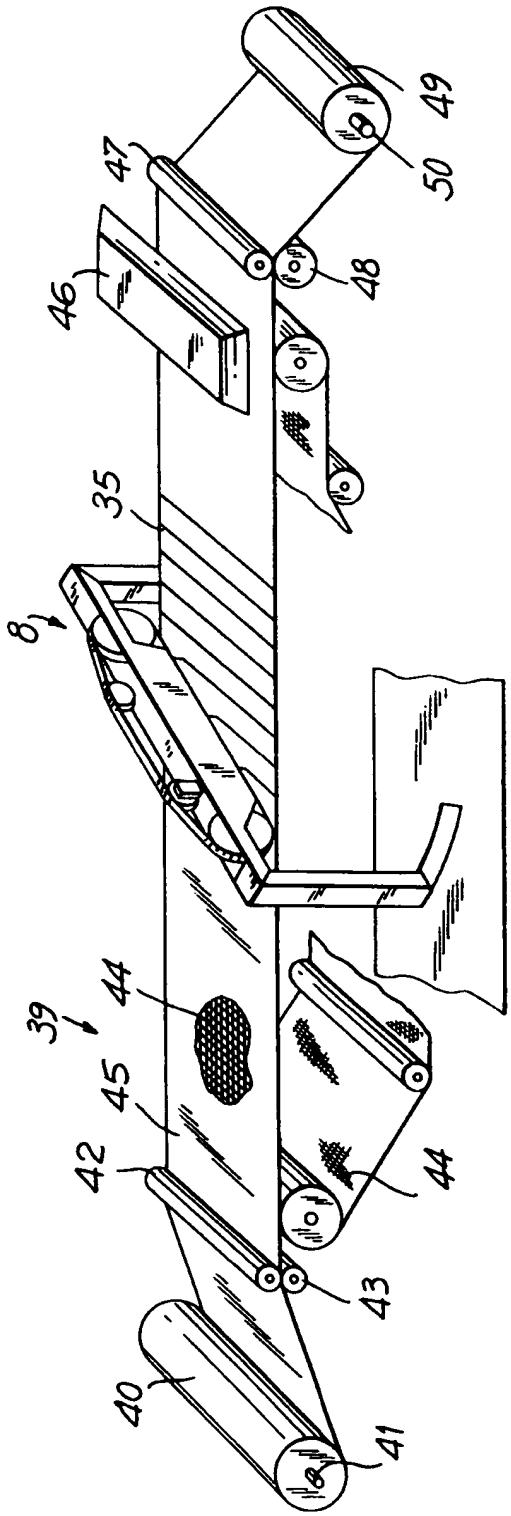



FIG. 4

FIG. 5

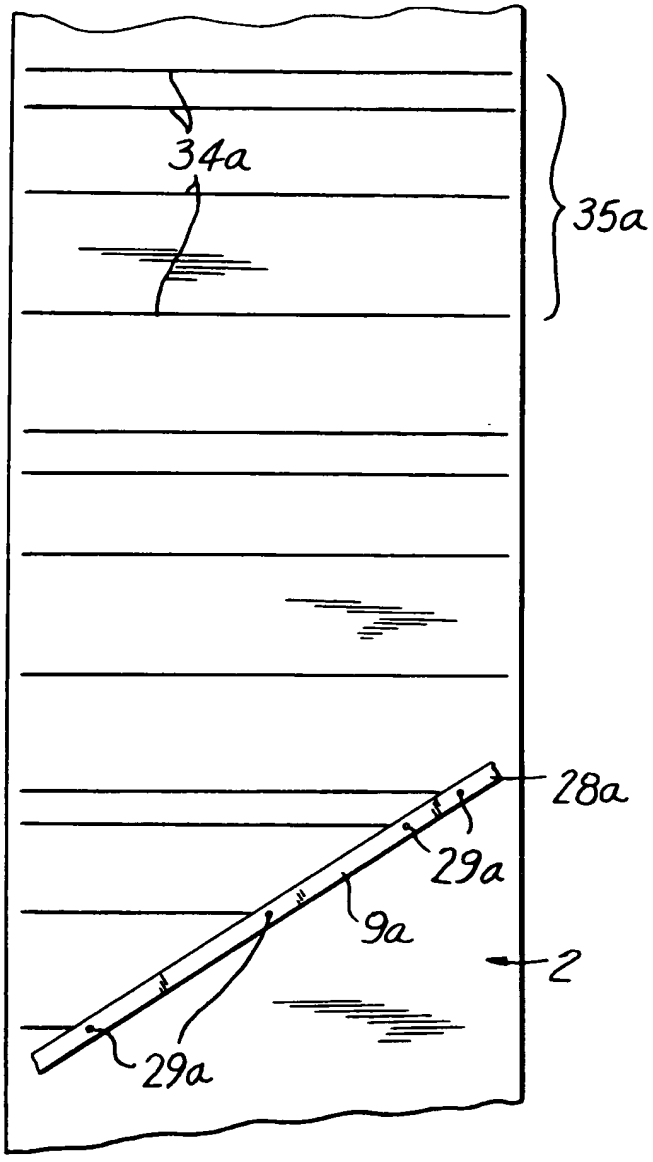
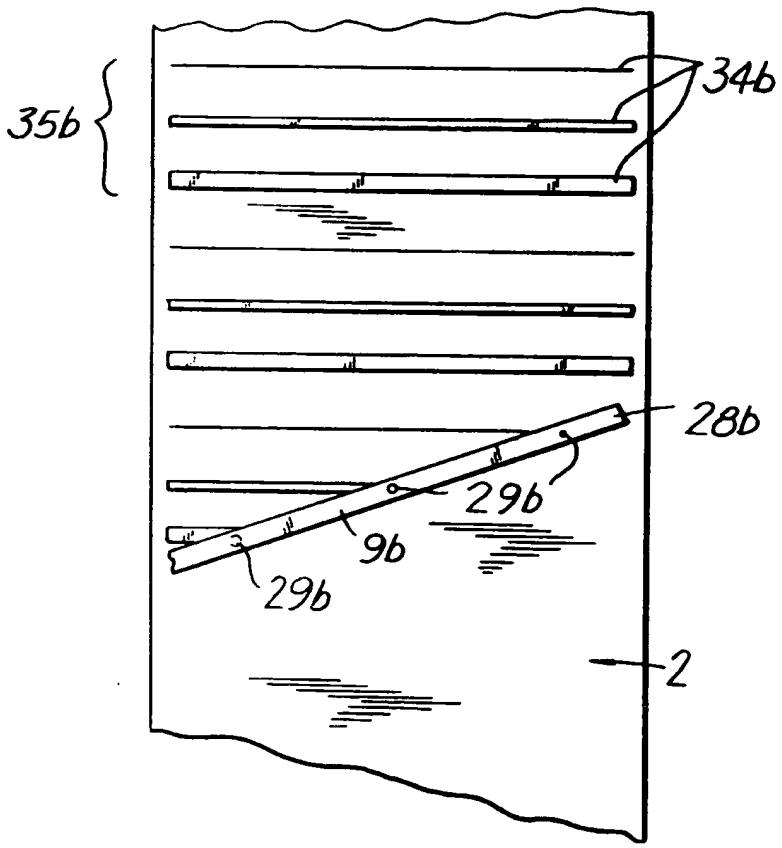


FIG. 6



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# EUROPEAN SEARCH REPORT

Application Number

EP 93 30 1619

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (Int. Cl.5) |
|---|---|---|---|
| P,X | EP-A-0 523 589 (ZWECKFORM BÜRO-PRODUKTE GMBH) | 1-3,18 | B05C5/02 |
| P,A | * page 4, line 37 - page 5, line 42; figure 1 * | 4-7,19, 20 | |
| X | FR-A-1 549 596 (FARBENFABRIKEN BAYER) * page 2, column 1, line 12 - line 24 * | 1-3 | |
| D,A | US-A-4 968 534 (BOGARDY) * column 5, line 24 - column 9, line 57 * | 1 | |

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

D21H
B05C
B05B

The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| THE HAGUE | 18 JUNE 1993 | VAN BEURDEN-HOPKINS |

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